

The rejection of Claims 1-11 and 25-33 under 35 U.S.C. § 112, first paragraph is respectfully traversed.

Claims 1 and 25 have been amended to recite "said feed water input line coupled in flow communication with said steam generator, said topping heater, and said high temperature water cracking system". Applicants respectfully submit that support for this amendment can be found in originally filed Figure 1. Particularly, Figure 1 shows feed water line 32 directly coupled to and in flow communication with steam generator 16. Figure 1 also shows feed water line 32 coupled in flow communication with topping heater 20 through steam generator 16, steam line 44, regenerative heat exchanger 40, and steam line 46. Figure 1 also shows feed water line 32 coupled in flow communication with high temperature water cracking system 18 through steam generator 16, steam line 44, regenerative heat exchanger 40, steam line 46, and topping heater 20.

Claims 1 and 25 have also been amended to recite "said feed water disassociated into hydrogen and oxygen in said high temperature water cracking system". Support for this amendment can be found at page 4, lines 25-28 of the specification.

For the reasons set forth above, Applicants submit that Claims 1 and 25 contain subject matter which is described in the specification in such a way as to convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed, and which is described in the specification in such a way as to enable one skilled in the art to make and/or use the invention. Accordingly, Applicants submit that Claims 1 and 25 meet the requirements of Section 112, first paragraph.

Claims 2-11 depend on independent Claim 1 and Claims 26-33 depend on independent Claim 25. When the recitations of dependent Claims 2-11 and 26-33 are considered in

combination with the recitations of Claims 1 and 25 respectively, Applicants respectfully submit that Claims 2-11 and 26-33 likewise meet the requirements of Section 112, second paragraph.

For the reasons set forth above, Applicants respectfully request that the Section 112 rejection of Claims 1-11 and 25-33 be withdrawn.

The rejection of Claims 1-11 and 25-33 under 35 U.S.C. § 103(a) as being unpatentable over Koutz (US 4,576,783) in view of either one of Interrante et al. (US 3,821,358) or Wentorf (US 3,842,164) is respectfully traversed.

Koutz describes a system for increasing the temperature of a fluid heated by a high temperature gas cooled nuclear reactor. The system includes a high temperature gas cooled nuclear reactor and a secondary closed loop of a working fluid. The fluid in the closed loop is heated in an intermediate heat exchanger in communication with the reactor coolant. The system also includes a heat pump to heat the working fluid to about 1500°F. The working fluid is then passed through a hydrogen production generator where the working fluid transfers heat to the hydrogen production generator. The working fluid in the closed loop then passes through a turbine, which is part of the heat pump, which cools the working fluid to about 1080°F. The working fluid is then passed through a steam generator to heat feed water for the hydrogen production generator to about 900°F, and is then directed back to the intermediate heat exchanger.

Claim 1 of the present application recites a system for generating hydrogen that includes feed water, a liquid metal nuclear reactor having a non-radioactive secondary heat loop, and a steam generator connected to the secondary heat loop. The steam generator is capable of raising the temperature of the feed water. The system also includes a high temperature water cracking

system with the feed water coupled to the water cracking system by a feed water input line, and a topping heater. The topping heater is capable of raising the temperature of the feed water, and the feed water input line is coupled in flow communication with the steam generator, the topping heater, and the high temperature water cracking system. The feed water is disassociated into hydrogen and oxygen in the high temperature water cracking system.

Claim 25 of the present application recites a system for generating hydrogen that includes feed water, a liquid metal nuclear reactor having a non-radioactive secondary heat loop, and a steam generator connected to the secondary heat loop. The steam generator is capable of raising the temperature of the feed water to between about 450°C to about 550°C. The system also includes a high temperature water cracking system with the feed water coupled to the water cracking system by a feed water input line, and a topping heater. The topping heater is capable of raising the temperature of the feed water so that the feed water in the high temperature water cracking system is at least about 850°C. The feed water input line is coupled in flow communication with the steam generator, the topping heater, and the high temperature water cracking system. The feed water is disassociated into hydrogen and oxygen in the high temperature water cracking system

Applicants respectfully submit that Koutz does not describe nor suggest a system for generating hydrogen as recited in Claim 1 or a system as recited in Claim 25. Particularly, Koutz has a closed loop heating circuit 22 that includes a working fluid that is heated by the heat exchanger (steam generator) 20, passes through the heat pump (topping heater) 28 where it is heated further, passes through the hydrogen production generator 30 to provide heat to the hydrogen production generator, passes through a steam generator 38 to add heat to the feed

water, and then is circulated back to the heat exchanger (steam generator) 20. In contrast, the system recited in Claim 1 and the system recited in Claim 25 do not include a closed loop heating circuit that utilizes a working fluid. Rather, in the claimed systems, the feed water is directed through an input line to the steam generator connected to the reactor secondary heat loop, the feed water is then directed through the input line to the topping heater, and then directed through the input line into the high temperature water cracking system (see Figure 1). In the Koutz system the feed water input line is not coupled to the steam generator connected to the reactor secondary heat loop, and the feed water does not pass through the heat exchanger connected to the reactor secondary heat loop. Also, the feed water input line is not coupled to the heat pump (topping heater).

Further, the Office Action suggests at page 5 that feed water recited in Claims 1 and 25 of the present application reads on the fluid in the secondary loop 22 of Koutz. Applicants disagree with this suggestion. Particularly, the fluid in the secondary loop 22 of Koutz just recirculates to carry heat from the heat exchanger coupled to the reactor to the process chamber in a closed loop. Specifically, the fluid in the secondary loop 22 does not enter the process chamber as feed water that is disassociated into hydrogen and oxygen in the high temperature water cracking system. As explained above, in the Koutz system the feed water input line is not coupled to the steam generator connected to the reactor secondary heat loop, and the feed water does not pass through the heat exchanger connected to the reactor secondary heat loop. Also, the feed water input line is not coupled to the heat pump (topping heater). Accordingly, Applicants respectfully submit that Claims 1 and 25 are patentable over Koutz.

Interrante et al. and Wentdorf are cited for teaching the use of a liquid metal reactor as a heat source for thermochemical production of hydrogen and oxygen. Interrante et al. and Wentdorf are not cited for, and do not teach or suggest a high temperature water cracking system with the feed water coupled to the water cracking system by a feed water input line coupled in flow communication with the steam generator, the topping heater, and the high temperature water cracking system.

Koutz, Interrante et al. and Wentdorf, alone or in combination, do not describe nor suggest a system for generating hydrogen as recited in Claim 1 or a system as recited in Claim 25. Particularly, and as explained above, Koutz, Interrante et al. and Wentdorf, alone or in combination, do not describe nor suggest a high temperature water cracking system with the feed water coupled to the water cracking system by a feed water input line coupled in flow communication with the steam generator, the topping heater, and the high temperature water cracking system. Accordingly Applicants submit that Claims 1 and 25 are patentable over Koutz, Interrante et al. and Wentdorf, alone or in combination.

Claims 2-11 depend on independent Claim 1 and Claims 26-33 depend on independent Claim 25. When the recitations of dependent Claims 2-11 and 26-33 are considered in combination with the recitations of Claims 1 and 25 respectively, Applicants respectfully submit that Claims 2-11 and 26-33 likewise patentable over Koutz, Interrante et al. and Wentdorf, alone or in combination.

For the reasons set forth above, Applicants respectfully request that the Section 103(a) rejection of Claims 1-11 and 25-33 be withdrawn.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Favorable action is respectfully solicited.

Respectfully submitted,

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PATENT

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Applicant: Boardman et al.

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For: SYSTEM AND METHODS OF
PRODUCING HYDROGEN USING A
NUCLEAR REACTOR

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: Examiner: R. Palabrica
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SUBMISSION OF MARKED UP CLAIMS

Commissioner for Patents
Washington, D.C. 20231

A marked-up version of amended Claims 1 and 25, in accordance with 37 C.F.R.
§ 1.121(c)(1)(ii), follows below.

MARKED UP CLAIMS

1. (twice amended) A system for generating hydrogen comprising:

feed water;

a liquid metal nuclear reactor having a non-radioactive secondary heat loop;

a steam generator connected to said secondary heat loop, said steam generator capable of raising the temperature of said feed water;

a high temperature water cracking system, said feed water coupled to said water cracking system by a feed water input line; and

a topping heater, said topping heater capable of raising the temperature of said feed water, said feed water input line coupled [to] in flow communication with said steam generator,

said topping heater, and said high temperature water cracking system, said feed water disassociated into hydrogen and oxygen in said high temperature water cracking system.

25. (twice amended) A system for generating hydrogen comprising:

feed water;

a liquid metal nuclear reactor having a non-radioactive secondary heat loop;

a steam generator connected to said secondary heat loop, said steam generator capable of raising the temperature of said feed water to between about 450°C to about 550°C;

a high temperature water cracking system, said feed water coupled to said water cracking system by a feed water input line; and

a topping heater, said topping heater capable of raising the temperature of said feed water so that said feed water in said high temperature water cracking system is at least about 850°C, said feed water input line coupled [to] in flow communication with said steam generator, said topping heater, and said high temperature water cracking system, said feed water disassociated into hydrogen and oxygen in said high temperature water cracking system.

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